Plan Evaluation and Selection Process

19629

A Summary Report

COMPREHENSIVE PLANNING ORGANIZATION
SAN DIEGO COUNTY, CALIFORNIA

PREPARED BY
BARTON-ASCHMAN ASSOCIATES, INC.

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Chapter 1
INTRODUCTION: THE ROLE OF EVALUATION

Plan evaluation represents one of the most critical, yet least advanced, phases of the comprehensive planning process. It constitutes a demanding assignment for any urban planning agency. Evaluation must be closely linked with the formulation of goals and objectives and represents the pivotal stage in planning when alternative plans are assessed in terms of how well they meet these goals and objectives.

Plan evaluation also can be regarded as the starting point for additional, more refined planning effort. Experience has shown that a recycling from plan evaluation back to additional goal formulation and development of alternative plans is especially desirable. Greater understanding of the potential impacts, benefits, and costs of alternative plans can then be gained. Figure 1 illustrates these basic relationships in the planning/evaluation process.

Several key characteristics of each of the three basic phases of the planning/evaluation process—goal formulation, plan development, and plan evaluation—will influence how well evaluation, itself, is conducted. These important elements are depicted in Figure 2.

THE PLANNING/EVALUATION PROCESS

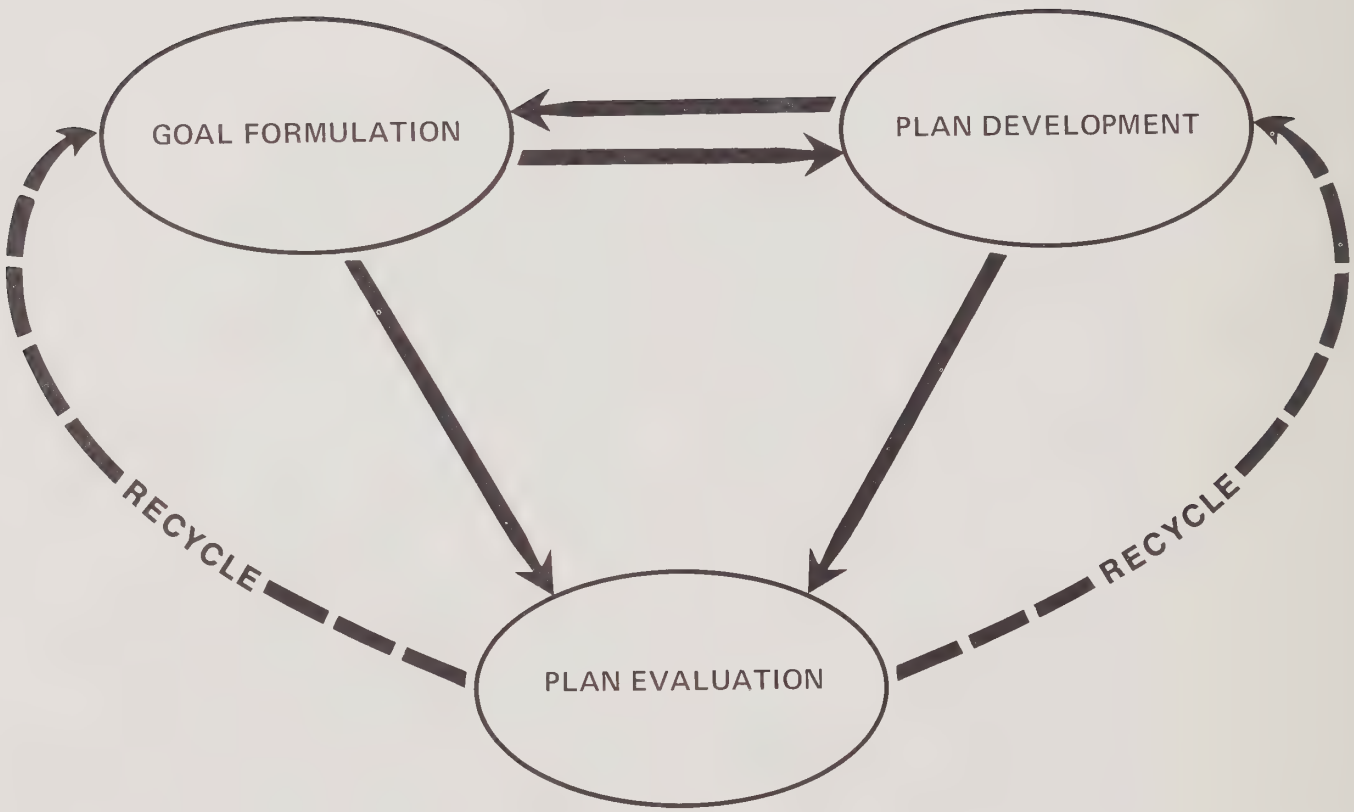
The *goal formulation process* must be structured so that it eventually yields two kinds of input for plan evaluation: criteria and measures, and relative goal weightings. Criteria and measures are vital for assessing, in some quantitative way, the degree to which different alternatives might actually contribute to achieving objectives. Relative goal weightings are needed to assist in evaluating conflicts and trade-offs among different goals and determining the consequences of sacrificing one goal to the advantage of another.

The *plan development process* must be oriented toward both the forecasting of future impacts and consequences and the detailing of plan components to describe subarea characteristics. The forecasting requirement has seen the development of a variety of computer-based mathematical models for predicting, for example, the effects of alternative land-use development concepts or transportation system configurations. The plan detailing requirement has, however, in many cases been incompletely met, with alternatives presented only at a generalized, regional level.

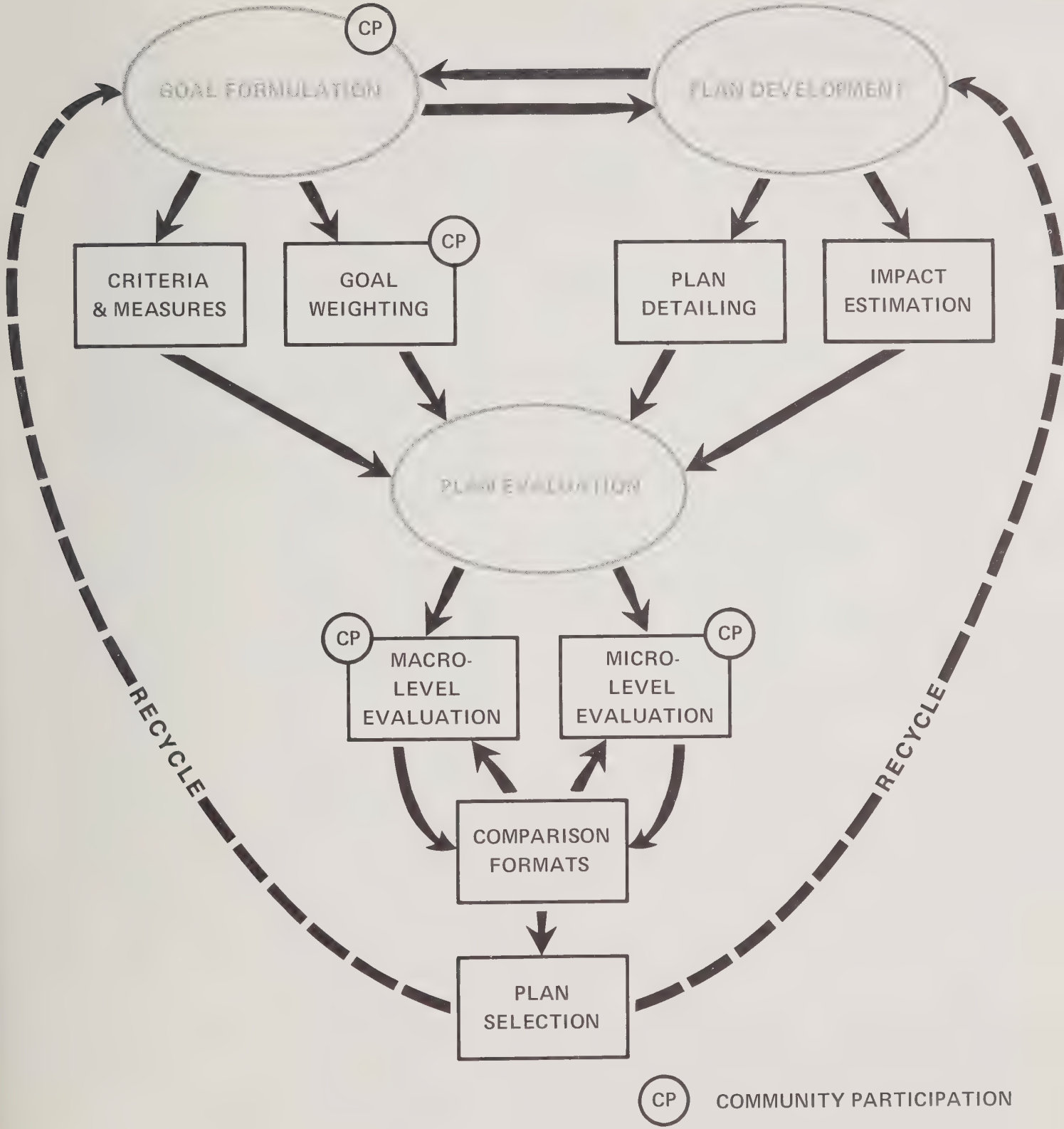
Recent trends in the *plan evaluation process* have aimed in part at overcoming this lack of sufficient subarea detail. Greater comprehensiveness has been sought. Because much of the problem is due to the insensitivity of forecasting models to subarea differences, with regional or large-district outputs only being emphasized, increasing concern for developing other ways of estimating and dealing with more localized, micro-scale impacts has emerged. Consequently, two different levels for plan evaluation—the macro or regional level and the micro or neighborhood/community level—can be distinguished.

A major approach to strengthening the micro-level evaluation places emphasis on community participation. Various techniques for participation have been suggested for eliciting citizen reaction and response, largely subjective in nature, to the various hypothesized local characteristics of overall regional plan alternatives. Community participation will, in fact, also play an important part in macro-level evaluation. The critical need for effective participation in goal formulation and goal weighting has already been recognized for some time.

Because plan evaluation will yield many differences, both quantitative and qualitative, among the alternative plans under consideration, another important element in the evaluation process lies in systematically comparing these alternatives. Various techniques for displaying and summarizing the



THE PLANNING/EVALUATION PROCESS
Figure 1



ELEMENTS AND LEVELS OF PLAN EVALUATION
Figure 2

impacts, benefits, and costs of alternatives might be utilized. Suitable comparison formats must be devised for integrating the results of both macro- and micro-level evaluations.

Figure 2 also reemphasizes that, upon the completion of the evaluation process, ending with the tentative selection of a preferred plan, the entire planning/evaluation process should be recycled.

Figures 1 and 2 provide a brief overview of the anticipated role of evaluation within the San Diego County regional planning program. The goal formulation and plan development phases of the Comprehensive Planning Organization's (CPO) work program are already well under way. This report represents a first step in the conduct of an accompanying plan evaluation procedure.

SUMMARY OF REPORT

Given that the basic relationship of plan evaluation to the identification of regional goals, the development of plan alternatives, and the prediction of alternative plan impacts upon goals is clearly established, plan evaluation itself can be undertaken with greater confidence. The following five chapters present a recommended strategy and work program for conducting the plan evaluation and selection process within the San Diego region. They are summarized briefly here.

Chapter 2 offers a summary of a State-of-the-Art review completed at the outset of the project. In this report it was concluded that major opportunities for improvement in plan evaluation methodologies exist. These opportunities fall in the areas of criteria and measures, goal weighting, comparison formats, and community participation. Five specific examples of plan evaluations conducted in other areas were reviewed along these dimensions. Key choices for San Diego were identified in strengthening its plan evaluation process.

A basic framework for plan evaluation is presented in Chapter 3. This framework stresses goal-achievement and cost-effectiveness approaches for the more systematic analysis of plan alternatives. An illustrative comparison format is developed which is built around cost-effectiveness ratios as a primary index of plan desirability. These ratios would reflect both a normalizing of plan impacts to permit trade-offs between objectives measured in different units and the assignment of relative weights to objectives to permit various summary weighted scores to be calculated. Several different tabular and graphical devices are then suggested as a means for strategically organizing the results of plan comparisons.

Chapter 4 presents a recommended staging concept for carrying out the evaluation activity. Three iterative cycles or stages are suggested. Stage 1 would deal primarily with macro-level or region-wide criteria and comparisons. Stage 2 would focus upon the more detailed, micro-level consequences of each alternative plan. After a preferred plan has been selected for the region, Stage 3 would then involve the evaluation of staging options for that plan. A fourth stage, project-level evaluation prior to implementation, is also identified, but falls beyond the scope of the recommended evaluation work program. The final section then summarizes a generalized version of the planning/evaluation work program to be carried out over the coming 22 months. Close coordination of specific evaluation tasks with related planning efforts, particularly involving the development of a Regional Policies Plan and Capital Improvements Program by CPO staff, is stressed.

In Chapter 5 considerations important in the development of evaluative criteria are discussed. (Detailed lists of preliminary criteria are presented separately in Chapter 10 of the full project report.) Several key characteristics of "good" criteria are identified. These include the full use of three different types of measures: monetary, other quantitative, and qualitative. They also include the derivation of criteria from three basic sources: mathematical models, additional data analyses, and subjective ratings. Criteria may be organized according to the goals and objectives against which they apply, and according to the various functional systems which will affect them. Examples of system performance, system feasibility (cost), socioeconomic impact, and governmental compatibility criteria are presented.

Chapter 2
STATE-OF-THE-ART REVIEW: A SUMMARY

A separate report on the state-of-the art in metropolitan plan evaluation was completed as the first step in this assignment.[1] This report focused on major problems and opportunities in plan evaluation, and identified key choices for San Diego in developing its own plan evaluation procedure. The bulk of the report consists of detailed reviews of five plan evaluation techniques employed in other areas.

EXAMPLES OF URBAN PLAN EVALUATION

These include examples from Boston (transit planning), Louisville (land-use/transportation planning), Minneapolis-St. Paul (transportation planning), Spokane (highway route location planning), and California (transportation corridor planning). Second, a review of major problems and opportunities presently at hand in metropolitan plan evaluation is presented. This is based not only upon the examples which have been examined, but upon a review of the growing body of literature dealing with systems analysis and plan evaluation in general. Finally, the third section then identifies key choices for San Diego in developing its own plan evaluation procedure. Opportunities for making a contribution to improving the state-of-the-art are plentiful.

Throughout this review, four basic elements in any plan evaluation procedure are emphasized. (The existence of a well-defined set of area-wide goals and objectives is assumed, together with the existence of appropriate forecasting and simulation models.) These include the following:

1. Identification and use of *criteria* for goal achievement. Both objective and subjective measures should be considered and utilized.
2. Identification and use of *trade-off techniques* for comparing the goals and objectives themselves. Experience has shown that the relative importance of different goals to different community interests must be explored in some way in order to achieve meaningful evaluation results.
3. Identification and use of *comparison formats* for assessing each alternative. Because a large body of information regarding each alternative is likely to be needed, some means for best organizing and presenting this information to those involved in the evaluation must be developed.
4. Identification and involvement of a *range of participants* in evaluation. Evaluation cannot be conducted by a planning staff alone, but must continuously involve decision makers, citizen advisory groups, representatives of special interest groups in the community and, in some way, the general public itself.

Table 1 summarizes the strengths and weaknesses of the five plan evaluation examples reviewed according to each of these basic evaluation elements.

The *Boston* regional transit plan evaluation, the earliest of the examples considered, represents a pioneering attempt to apply the systems approach in urban planning. It proceeded through a series of explicit steps, including goal identification, goal weighting, identification of alternatives, prediction of effectiveness, calculation of a single summary score for each alternative, and the selection of a preferred alternative. The approach was illustrated via a simple example. While the calculation of a single cost-effectiveness ratio or score for each

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[1] *State-of-the-Art in Metropolitan Plan Evaluation* (Prepared for the San Diego County Comprehensive Planning Organization by Barton-Aschman Associates, Inc., January, 1972).

Table 1
STRENGTHS AND WEAKNESSES: FIVE EXAMPLES OF URBAN PLAN EVALUATION

Plan Evaluation Examples	Evaluation Element			
	Criteria and Measures	Goal-weighting	Comparison Formats	Range of Participation
Boston Regional Transit	Quantitative characteristics only.	Preliminary staff ratings.	Summary index for each alternative.	Staff only.
Louisville Effectiveness Matrix	Qualitative characteristics only.	Ranking and rating surveys.	Summary index for each alternative.	Citizens Advisory Committee.
Twin Cities Rank-sensitivity	Both quantitative and qualitative characteristics.	No direct weighting.	Summary index used; sensitivity of alternatives to varying goal weights tested.	Indirect via previous planning activities.
Spokane Roadway Evaluation	Both quantitative and qualitative characteristics.	Paired comparisons surveys.	Summary index for each alternative.	Citizens Advisory Committee; other groups explored.
California Freeway Location	Both quantitative and qualitative characteristics.	Rating surveys.	Graphic profiles used to display differences among alternatives.	Several groups explored.

alternative was discussed, it was not attempted. Apparently only the planning staff and its consultants participated, essentially on an experimental basis.

The *Louisville* effectiveness matrix technique was also largely experimental in nature and was developed in association with the metropolitan land-use/transportation planning program. In some respects it represents a refinement of the systematic approach used in Boston. For example, the weighting of objectives was done with the assistance of the Mayor's Citizens Advisory Committee, who participated in both goal ranking and rating surveys. Again, a summary-weighted index score for each alternative was calculated, but a larger number of objectives was included. This was accomplished through the use of an "effectiveness matrix" which matched goals against alternatives. However, only subjective estimates of effectiveness were utilized (qualitative assignment of numerical effectiveness ratios).

The *Twin Cities* rank-sensitivity evaluation, applied preliminarily in association with a transportation planning program, made advances over both the Boston and Louisville examples in the area of goal achievement criteria and measures. Both objective (data-based) and subjective (ranking and rating) types of measures are included explicitly. An attempt is made to include both direct and indirect transportation objectives, utilizing the goals and objectives previously adopted for the region. Community participation was included only to the extent that it was incorporated within these previous goal formulation efforts. No direct weighting of goals was attempted. Instead, a computerized procedure for assigning a large number of different random weights to objectives was employed to examine the sensitivity of plan rankings. Alternative plans were first ranked via a summary index score, which was then varied according to many different sets of goal weights.

While the three previous examples were essentially concerned with region-wide or macro-levels of evaluation, the remaining two deal with micro-level or project-oriented evaluation. Both are still applicable at the metropolitan plan evaluation level. In *Spokane,* a procedure combining some of the features of the previous two examples (Louisville and Twin Cities) was devised. It also was conceived in association with a metropolitan transportation planning program. Again a Citizens Advisory Committee was utilized to assign weights (via a paired comparisons survey) to a fairly small list of objectives. Surveys of other community groups were also explored. As in the Twin Cities, both quantitative and qualitative types of criteria were utilized. Using a roadway location evaluation context, summary index scores for alternative roadway types were calculated, and the alternative with the highest score selected.

The *California* freeway location evaluation was based upon work performed at Stanford University. Here the focus was upon dealing with potential freeway location controversies via improved, more comprehensive evaluation procedures. It was suggested that traditional engineering and highway economic factors be treated separately from community impact factors. Though the proposed evaluation procedure was not applied to a specific example, surveys were conducted of several community groups to show how attitudes (and potential goal weights) for these groups differed. Goals in relation to economic and community factors were not explicitly established, but both quantitative and qualitative criteria for measuring impacts in these areas were suggested. The example stresses the use of graphic "community factor profiles" to display differences among alternatives and argues against the use of single summary scores, which may suppress too much valuable information.

PROBLEMS AND OPPORTUNITIES IN PLAN EVALUATION

Table 2 briefly lists the key problems and opportunities in metropolitan plan evaluation suggested by the examples reviewed. Fifteen critical aspects of evaluation are recommended for consideration by the San Diego CPO and its policy and advisory committees. These critical areas of choice in evaluation design, around which the chosen evaluation procedure should be structured, have been organized according to the four basic evaluation elements described above. Several important issue areas also relate to a fifth category, the broader planning/evaluation process.

In relation to this *overall planning process,* it is important that the cyclic or iterative aspect of evaluation be clearly anticipated. What level of detail is desired, how many cycles should be conducted, and over what time period? Coordination with the preparation and detailing of alternative plans should be sought. In considering the need for both macro- and micro-level evaluations, decisions regarding the degree to which alternatives are stratified by geographic subarea and by the socioeconomic group affected should be made. Similarly, the level of detail to which recommended goals-objectives hierarchies are carried by

Table 2
PROBLEMS AND OPPORTUNITIES IN METROPOLITAN PLAN EVALUATION

Evaluation Element	Critical Aspects
A. Planning/Evaluation Process	1. Cycling of Evaluation 2. Preparation of Alternatives 3. Stratifying Alternatives by Area 4. Stratifying Alternatives by Group 5. Goals-Objectives Hierarchies by Area 6. Goals-Objectives Hierarchies by Group
B. Criteria and Measures	7. Model-based Criteria 8. Forecasting other Quantitative Criteria 9. Forecasting Qualitative/Subjective Criteria
C. Goal-weighting	10. Methods of Goal-weighting
D. Comparison Formats	11. Sensitivity Analyses of Goal-weightings 12. Sensitivity Analyses of Forecasts 13. Summary Indices 14. Presentation of Results
E. Range of Participation	15. Participation in Each Evaluation Cycle

subarea and/or socioeconomic group must also be selected.

Key issues involving *criteria and measures* center mainly on the types of measurement which will be utilized and on how they will be forecasted. The three basic types of measures—economic (dollar-valued), other quantitative, and qualitative (ratings and rankings)—can be predicted in at least three ways. Some criteria may be based on the outputs of land-use, transportation, and other computer-based simulation models. Others might be forecasted using less rigorous quantitative analysis techniques, while still others might be projected on the basis of expert opinion and/or citizen/community/decision-maker perceptions. Which types of criteria to utilize, and how, will represent major areas of choice.

The difficult area of *goal-weighting* will be critical primarily in choosing among various survey and interactive techniques intended to clarify values. There will also be a close tie here to *range of participation* questions, though community and decision-maker participation is envisioned to include at least the goal formulation and macro- and micro-level assessment stages, as well as goal-weighting (see Figure 2).

The development of *comparison formats* will also call forth several significant issue areas. One will involve the possibilities for employing sensitivity analyses of goal-weightings to soften the uncertainties associated with changing values, while another will involve similar sensitivity analyses of impact forecasting uncertainties. The proper identification of impacts, generally in terms of benefits and disbenefits which relate directly to measures of goal achievement, will be crucial. The comparative handling of impacts will also influence the degree to which summary indices of plan performance are or are not desirable (another choice area), as well as the manner in which the results of evaluation are communicated to decision makers and others. Many different forms of communication or presentation might be utilized.

Chapter 3
FRAMEWORK FOR EVALUATION

As noted in the State-of-the-Art report, a systematic approach to evaluating regional growth and development alternatives in the San Diego region will require that some type of coordinated cost-effectiveness strategy be utilized. The cost-effectiveness concept essentially represents an expansion of traditional cost-benefit methodologies to include nonmonetary impacts and to relate benefits or impacts specifically to a set of well-defined goals and objectives. The approach thereby allows a consideration of the indirect effects of plan alternatives which otherwise have often been seriously slighted.

In the procedure for plan evaluation which has evolved under this assignment, the cost-effectiveness approach will permit the outputs of various mathematical forecasting models (such as PLUM and the mode split model) to be included directly within plan evaluation efforts, in the form of evaluative criteria matched against relevant objectives. Similarly, it will allow the goals and objectives currently under development in the Regional Goals Program to be incorporated directly within subsequent evaluation activities.

While these goals and model forecasts represent two of the three critical ingredients in cost-effectiveness evaluation, the third ingredient, forecasts of costs, will require some degree of additional effort by CPO staff. These cost forecasts will build upon functional planning efforts, currently under way or anticipated, in transportation, drainage and flood control, open space, and water and sewer utilities.

A COST-EFFECTIVENESS STRATEGY

At this time, an outline of a recommended strategy for utilizing cost-effectiveness comparison formats is presented. It is intended to serve as a basis for carefully comparing all of the important consequences of each alternative regional plan. At least four critical features of this approach to evaluation should be mentioned:

1. A comparison procedure must be designed which will permit the three *different types of criteria* identified subsequently in Chapter 5 to be brought within a single evaluative framework. These quantitative measures, to be matched against relative goals and objectives, deal with system performance at the regional level, system feasibility at the regional level, and socioeconomic impacts at both regional and local levels. The framework should also permit additional non-model based and/or qualitative criteria to be included on an equal footing—such as governmental capability criteria.

2. The chosen evaluative framework should also permit the direct utilization of *alternative sets of goal weights,* as discussed in Chapter 2. Whether these weights are derived via various survey techniques, or other participatory mechanisms, the fact that some goals will be regarded as more important than others should be reflected in the evaluation effort. Allowance must also be made for different sets of weights to be easily considered, given that many different groups and interests in the region are likely to regard the region's goals in different ways.

3. The selected evaluation framework probably should also be *amenable to staging.* At least two important reasons for dividing the evaluation activity into two (or more) successive stages can be suggested.

   a. Some goal areas are much more strongly related to current model-building and functional planning activities than others. These goal areas (regional growth, physical form, environmental quality, transportation, open space, and housing) consequently probably should be dealt with early in the evaluation

process. The remaining objectives, however (education, human resources, and governmental structure), appear to be more loosely tied to the manner in which plan-form alternatives are currently being specified. It may be necessary to defer consideration of these objectives to later, more detailed phases of evaluation.

b. It is also in the same six functionally-oriented goal areas that a wide range of criteria have been identified. Many of these criteria, moreover, appear to have important implications for assessment at both overall regional levels and at highly disaggregated levels (census tracts and traffic analysis zones). Because a considerable amount of work would be involved in conducting a goal-achievement assessment for many different levels of aggregation, it may be desirable to break the consideration of these six goal areas into two (or more) stages. The first stage would deal with gross regional criteria, while the second stage would deal with more detailed, disaggregated criteria.

This concept of evaluation cycling or staging emerged as an important concern in the State-of-the-Art report. The manner in which regional goals and associated evaluative criteria are currently emerging in the San Diego region also suggests that a staging may be necessary to make the evaluative process more workable. (This subject—refinement of goals and criteria—is considered further in a separate chapter in the full project report.)

4. The *communicative or display aspects* of the evaluation process should also be treated carefully. Regional decision makers should not be faced with a choice only between a single summary index representing the effectiveness of each plan alternative, and a wealth of forecasted data and goal weights which would be nearly impossible to digest in a short period of time. Different levels of summarization of the results of plan evaluation should be pursued.

While a single index score for each plan alternative may be desirable, it should be supplemented with a series of sub-indexes. These sub-indexes might relate, for example, to each of the nine goal areas. They might relate to the five or six different functional plans being pursued. Or they might relate to different major subareas within the region. The point here is that the evaluation framework should not oversimplify this complex task, though it must still be helpful in better organizing and presenting the important impacts and corresponding levels of effectiveness.

BASIC COMPARISON FORMAT

Table 3 offers an example of how a *cost-effectiveness summary sheet* might bring all four of these considerations together. It is recommended as a basic device for conducting evaluation. Some of its important characteristics are listed below:

a. One such summary sheet would be prepared in each of the nine goal areas. If four plan alternatives were being evaluated, 36 such summary sheets would be required. In addition, an overall summary sheet covering the nine goal areas themselves would also be required, bringing the total number of cost-effectiveness summary sheets to 40.

b. However, important considerations in sequencing the manner in which goals are examined are likely to affect the number of summary analyses required. There are two dimensions here. First, as noted above, it is probable that objectives in the three goal areas relating to social services will be amenable to meaningful evaluation only at later stages in the evaluation process. This may be possible only when a single physical form alternative has been selected, and considerable additional detail as to its staging and implementation is added. Summary cost-effectiveness sheets in these areas, together with the supporting analyses upon which they would be based, can be set aside for the moment.

c. An additional important factor involves the manner in which objectives in the area of regional growth and economic development are to be assessed. It is possible that the two or three growth options advanced here (slow, moderate, or accelerated levels of growth) could only be fully examined in terms of how these different levels of growth would be reflected in each of the other five goal areas relating to physical or land-use characteristics (housing, open space, transportation, environment, and physical form).

Consequently, if time and budget permitted, each of the four physical form alternatives (existing trends, controlled trends, radial corridors, and multiple centers) could conceivably be

Table 3
ILLUSTRATIVE COST-EFFECTIVENESS SUMMARY SHEET

GOAL AREA: _____

ALTERNATIVE PLAN: _____

Objectives	Criteria(1)	Forecasted Impact(2)	Normalized Impact(3)	Average Score(4)	Relative Weight(5)	Weighted Score
1.	a.					
	b.					
	c.					
2.	a.					
	b.					
3.	a.					
4.	a.					
5.	a.					
	b.					
	c.					
	d.					
6.	a.					
Summary Score				XXX		XXX
Applicable Costs				$$$		$$$
Cost-Effectiveness Ratio				XX/$$		XX/$$

(1) Name of criteria; three types—monetary, other quantitative, qualitative.

(2) Value of criteria; three sources—model-based, other data-based, subjective ratings.

(3) Appropriate ranges of possible impact must be established to permit this step.

(4) Only one score permitted for each objective.

(5) As derived from Delphi surveys or similar goal-weighting techniques.

carried forward in terms of two or three possible levels of growth. This would result in a total set of some eight to 12 alternative plans. In the six goal areas to be evaluated here, there would consequently be some 50 to 70 different cost-effectiveness summary sheets. The need for well-organized and easily understood cost-effectiveness analyses becomes immediately clear.

d. Note that three different types of quantitative measures or criteria—monetary, other quantitative, and qualitative—would all be treated on an equal basis. Each objective would be matched against one or more quantitative criteria, which may have been derived in any of three ways—via model-based data, via other quantitative data, and via subjective ratings cast in numerical form. Both objective (data-based) and subjective measures would serve equally well in indicating the degree to which different objectives might be achieved.

e. These three types of measures would correspondingly be forecasted in three different ways. The significant outputs of all of the mathematical models currently available, under development, or anticipated within the region would be incorporated here. Forecasts of other quantitative data, both as spin-offs from model output and based upon supporting plan analyses and estimates, would also be required. Finally, subjective or qualitative ratings (in numerical form) would also be made of anticipated future-year impacts. These ratings might simply compare one alternative with another (perhaps utilizing ordinal rankings), or they might rate each alternative against some previously established qualitative scale.

f. In order to permit trade-offs and comparisons between objectives to be made, it will be necessary for them to be converted to a common scale. A convenient common scale exists in the concept of "normalization," where each forecasted impact value would be converted to a corresponding percentage of the maximum or minimum value which might conceivably have been achieved. Computing these normalized percentage scores requires that a *range* of feasible maximum and minimum values for the measures associated with each objective be established. The normalized value would then represent the appropriate percentage of that range. Consequently, relatively simple supporting analyses (which may involve subjective judgment) will be required to set these ranges.

g. While it will be acceptable and desirable for more than one measure to be associated with each objective, it should be recognized that, for consistency in evaluation, only one average measure can be used in comparative analyses. This is necessary to eliminate the possible double-counting which would otherwise occur. Since each objective will have received a relative weight, that weight must be assigned to a *single* score or measure in subsequent comparative analyses of objectives and trade-offs between them.

   Consequently, at some point a decision should be made to either select the "best" measure for each objective or compute an average measure. One of the important factors involved here will be consideration of the most meaningful level of disaggregation at which objectives might be analyzed. Even within a two-stage evaluation process, there will still be six different levels of aggregation, at which many regional data may be reported, from which to choose.

h. The relative weights assigned to each objective would also be included in a cost-effectiveness summary sheet. These weights would have been derived from Delphi surveys (or similar techniques) in which various community groups participated. It would be entirely possible for different sets of weights to be introduced here, so that the subsequent calculation of weighted plan scores in each goal area could be repeated as many times as needed.

i. In each goal area, and for each plan alternative, a weighted score would be computed. This would represent simply the sum of the products of each objective score times its associated weight. Note that, if desired, an unweighted goal score could also be calculated. The cost-effectiveness summary sheets in which the nine goal areas themselves are listed would then contain each of these individual goal-area weighted scores. The goal areas themselves might then be weighted and an overall summary index score for each alternative derived. Further study of the desirability of an overall single index score for each plan alternative should be conducted, however.

j. As a part of the supporting cost analyses which will be necessary, covering the costs of the five or six major functional plans supporting the overall plan, as well as local governmental service costs, it will be necessary to determine which of those costs are applicable in each of the goal areas under consideration. Overlap would be

permitted, so that costs for the regional highway system could, for example, be matched against both transportation and physical form goal areas. In the final overall goal table, however, all functional system and local service costs would be reported only once, in a single unit.

k. The final entry in the cost-effectiveness summary sheets would then consist of the calculation of a simple cost-effectiveness ratio. Such a ratio would be determined in each of the different goal areas, and, if desired, for the overall goals comparison table. These cost-effectiveness indexes would be calculated for each of the plan alternatives under consideration. Again both a weighted and an unweighted index score might be calculated.

l. Finally, the sensitivity of these cost-effectiveness indexes should also be explored. These sensitivities will depend upon both forecasted impact values and upon the relative weights assigned to each objective. They will also depend upon the reliability of cost forecasts, and examination of sensitivities to variation here might also be desirable.

The State-of-the-Art report emphasized that properly conducted sensitivity analyses represent a major area for improvement in plan evaluation methodologies. They also appear to have potentials for computerized modeling. Possible procedures for sensitivity analyses are the subject of a separate chapter in the full project report. The idea here will be simply to examine how the cost-effectiveness ratios for different plan alternatives might change, given that forecasted impacts, relative weights, and forecasted costs are allowed to vary within certain reasonable ranges.

SUMMARIZING PLAN COMPARISONS

Once a series of cost-effectiveness summary sheets have been prepared for each plan alternative, it will be necessary to compare alternatives, one against another. A set of 50 or more such cost-effectiveness tables would be somewhat difficult to digest, and further graphic and visual displays of the differences between plan alternatives should be explored. A range of communication devices for this purpose are discussed in a separate chapter in the overall project report. Figures 3, 4, and 5 begin to show the types of devices which will be needed.

Figure 3 illustrates one possible plan comparison device: a goals-achievement profile. Such a profile would permit the differences among all four plan-form alternatives to be compared at once, in each of the different goal areas. Consequently, only nine or 10 such profiles would need to be prepared. They would permit decision makers to grasp essential differences among the alternatives more quickly. Note, however, that in this hypothetical example, no single alternative stands out as superior to the others.

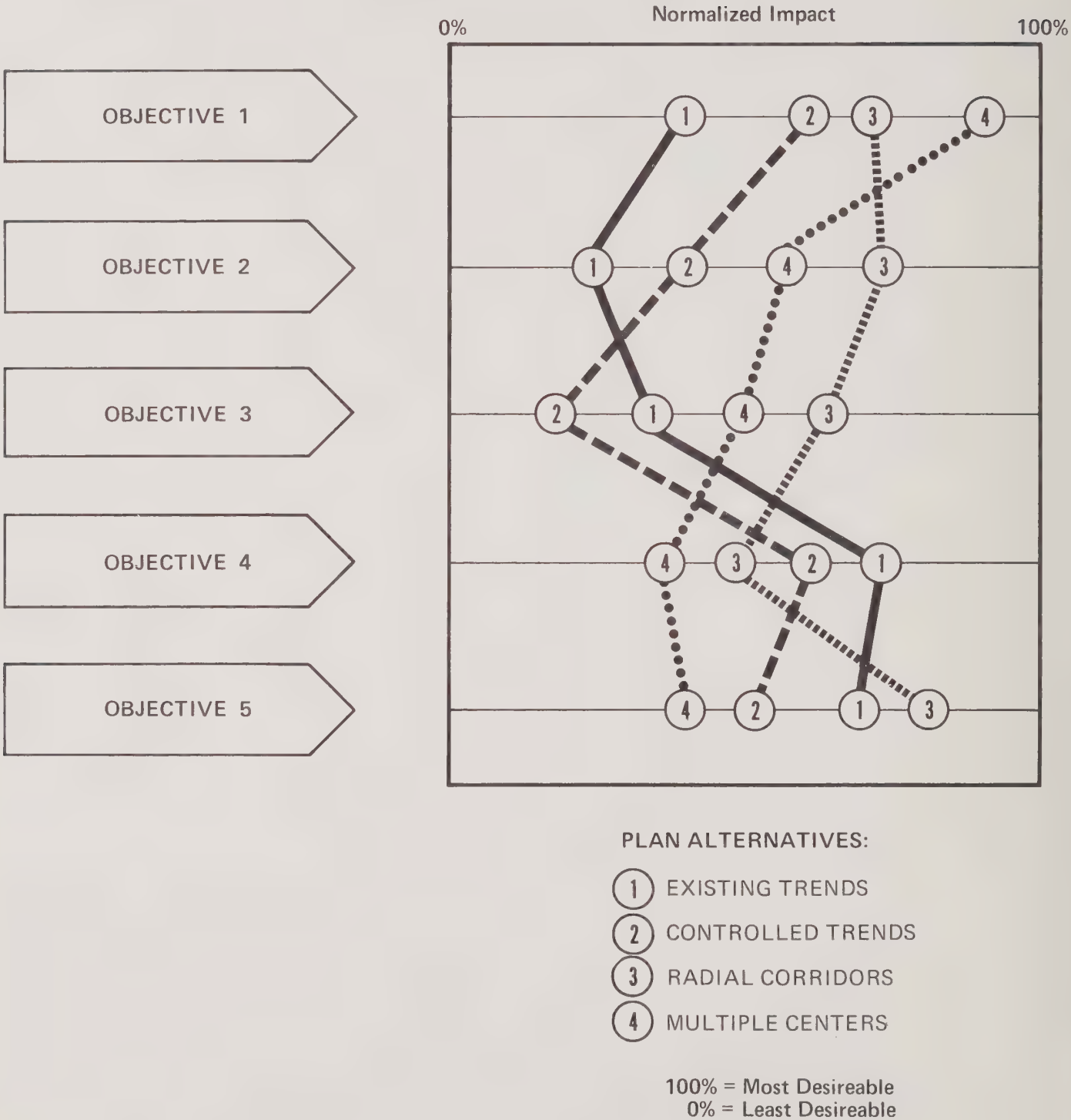
A similar profile could be prepared which presents the *weighted* scores derived for each objective, rather than the unweighted normalized impacts depicted here. While such weighted scores may tend to bring one of the alternatives more to the forefront, it should be recognized that, even when goal weights have been assigned, the possibility for further subjective trade-offs among objectives in the final selection of alternatives will still exist. The purpose of profiles such as these will then be to clarify just what these trade-offs are. The final decision will still belong to the region's decision makers.

Figures 4 and 5 return to a format which is parallel to that of the individual cost-effectiveness summary sheets. Figure 2 suggests how the different plan alternatives might be compared at the regional level, using the same criteria, summary scores, and cost-effectiveness ratios depicted earlier. Again such a sheet would be prepared in each of the nine goal areas. It is suggested that three key measures be shown for each criterion—its forecasted 1995 value, its current value, and the weighted score for its associated objective (as defined earlier). The various features of each alternative could then be quickly compared.

Figure 4 comparisons would be largely macro-level in nature, most often dealing with summary measures for the region as a whole. Another device, such as that shown in Figure 5, will be needed to convey plan differences in terms of micro-level or community impacts. Different comparison sheets, one for each goal area, would now be prepared for each of the important communities or jurisdictions within the region. On each sheet, forecasted values, current values, and weighted scores would be shown for each community-level criterion. For ease of comparison with the regional analysis, Figure 4 weighted scores would also be included.

Summary scores and cost-effectiveness ratios for both the affected community and the region, for each alternative, would also be shown. In this way, any major conflicts which exist between regional

GOAL AREA: _____



ILLUSTRATIVE GOAL-ACHIEVEMENT PROFILE
Figure 3

GOAL AREA _____

OBJECTIVES	CRITERIA	PLAN EFFECTIVENESS CHARACTERISTICS Alternative A	Alternative B	Alternative C	Alternative D
1.	a.				
	b.				
	c.				
2.	a.				
	b.				
3.	a.				
4.	a.				
5.	a.				
	b.				
	c.				
	d.				
6.	a.				
SUMMARY SCORE		XXX	XXX	XXX	XXX
APPLICABLE COSTS		$$$	$$$	$$$	$$$
COST-EFFECTIVENESS RATIO		XX/$$	XX/$$	XX/$$	XX/$$

FORECAST VALUE

CURRENT VALUE / WEIGHTED SCORE

ILLUSTRATIVE PLAN COMPARISONS SHEET: REGIONAL LEVEL

Figure 4

GOAL AREA _____

OBJECTIVES	CRITERIA	PLAN EFFECTIVENESS CHARACTERISTICS: Alternative A	Alternative B	Alternative C	Alternative D
1.	a.				
	b.				
	c.				
2.	a.				
	b.				
3.	a.				
4.	a.				
5.	a.				
	b.				
	c.				
	d.				
6.	a.				
SUMMARY SCORE		C / R	C / R	C / R	C / R
APPLICABLE COSTS		C / R	C / R	C / R	C / R
COST-EFFECTIVENESS RATIO		C / R	C / R	C / R	C / R

FORECAST VALUE: CURRENT VALUE / C WEIGHTED SCORE; R WEIGHTED SCORE

C = LOCAL COMMUNITY R = REGION

ILLUSTRATIVE PLAN COMPARISONS SHEET: COMMUNITY LEVEL
Figure 5

and local goals could be clarified. Differences in plan desirability at the regional and local levels will be readily discernible. In fact, one way to generate these community level comparisons might be to start with the regional comparisons sheet and begin to look for significant local deviations or disagreements.

Various citizen participation techniques are likely to be needed to generate the weighted scores upon which these community differences would, in part, hinge. While forecasted impact values will generally be derived from the region's mathematical models (though some criteria will also deal with qualitative ratings, at both regional and local levels), the weights assigned to objectives are quite likely to vary from community to community. Regional-local differences in plan desirability could consequently be derived from either relatively different growth rates in impacts (forecasted vs. current values) or from different goal weights—or from both.

Additional information, beyond the quantitative data displayed in Figures 4 and 5, also will be required for effective citizen participation in community-level plan evaluation. This will be likely to include a variety of maps, sketch plans, models, drawings, figures, graphs, and other visual devices for depicting plan differences at the local level. Various specific citizen participation techniques for considering this broad range of information in community-level evaluation are discussed in a separate chapter in the overall report. Possible methods for goal weighting, as a part of citizen participation, are also discussed in a separate chapter, and as a part of the work program presented in Chapter 5.

Though additional maps, models, and other presentation techniques may be useful in facilitating community interaction in plan evaluation, it should be recognized that these devices will still rely on the basic forecast data to be presented in Figure 5 comparison sheets. These data may be further *interpreted* in terms of local consequences and characteristics, but they still will represent the most fundamental outcomes of each alternative plan. Further subjective interpretation and evaluation of those outcomes represents, in a sense, the heart of the evaluation activity.

Finally, the need for a third type of plan comparisons sheet, one which would "aggregate" the many different community-level evaluations, should be noted. Such a comparison sheet would probably be quite similar to the format of Figures 4 and 5. Perhaps one community-level summary sheet could focus on regional/local differences, while another summarizes those communities whose assessment was essentially in concurrence with regional-level results. A check against the initial regional-level evaluations should be made, and all results transferred to regional decision makers for their deliberation.

Chapter 4
STAGING OF EVALUATION

It is anticipated that the evaluation of alternative regional development patterns will continue over a period of some 15 months. Considerable effort by CPO staff, consultants, citizens, and decision makers will be required. An additional evaluation input will be needed in the subsequent staging of the recommended regional plan.

In this chapter, an overall staging concept is presented for better organizing this complex evaluation activity. Three iterative cycles of evaluation are recommended, with each cycle adding additional data and subarea detail.

This staging concept is then more carefully worked out in the form of a time-phased work program for the plan evaluation and selection process. A generalized work program, requiring some 140 man-months of staff and consultant effort, is presented in this chapter. A more detailed task description for each of the 42 recommended planning/evaluation work items is presented in the full project report.

EVALUATION CYCLES

As suggested strongly in the State-of-the-Art report, the *staging* or *cycling* of the evaluation of plan alternatives in San Diego will represent a critical aspect of this endeavor.

In general, both the cost-effectiveness tables and the goals-achievement profiles described above should be utilized during each stage of evaluation deemed necessary. One of the constraints to be placed upon such evaluative tools is that they be applicable at different levels or scales of evaluation, from the broad regional level to the local project level.

Figure 6 outlines the recommended staging of plan evaluation. It is intended to provide a basis for strengthening the overall planning/evaluation process. Note that it identifies important evaluation activities which will extend beyond the period addressed by the work program. It should be recognized that, even after a single alternative plan has been selected, considerable evaluation effort will be needed to determine how such a plan should be best staged and implemented.

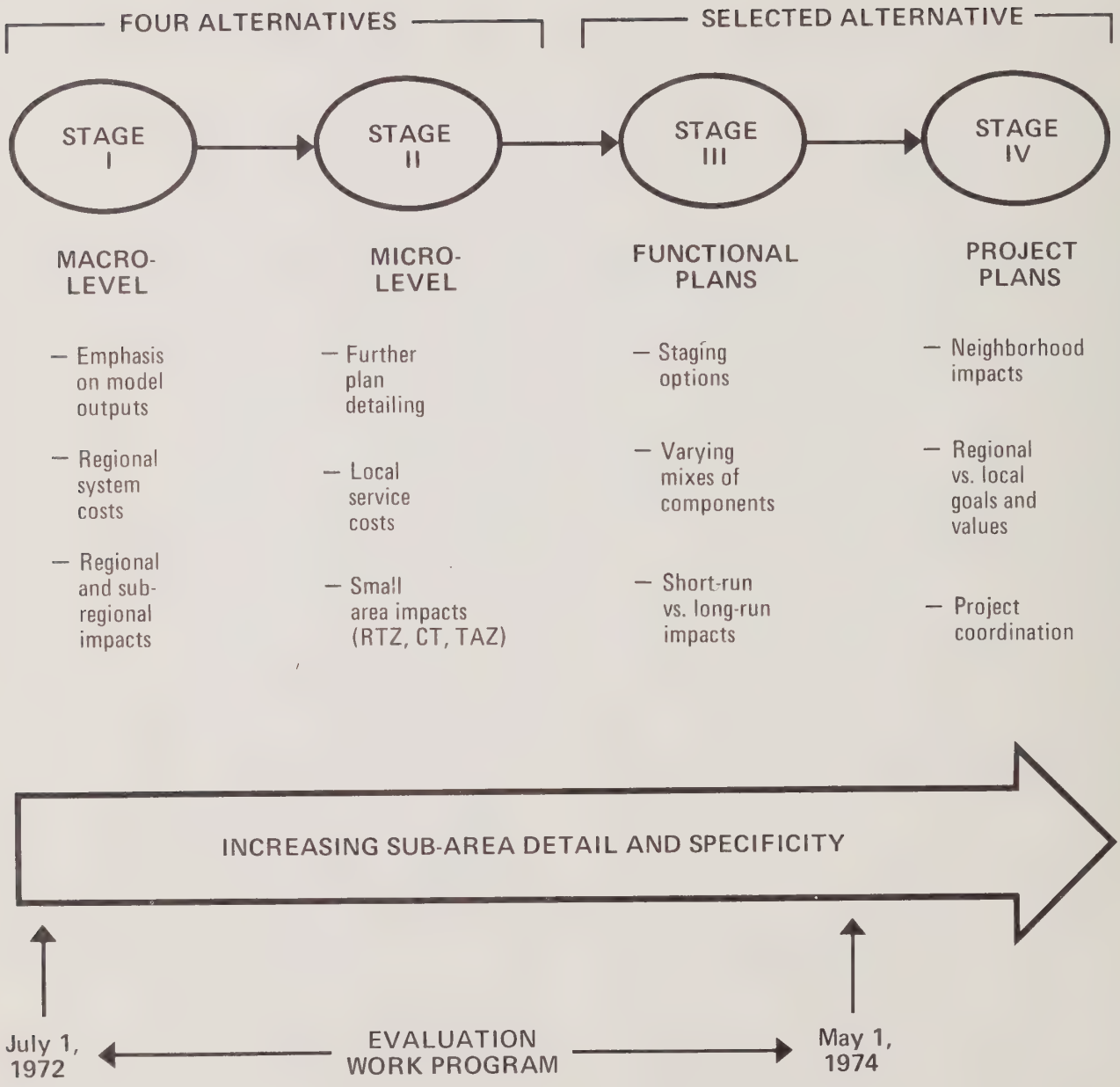
Over the period of the primary evaluation activity in the San Diego region (roughly, from July 1, 1972 to July 1, 1973), it is suggested that two major stages of evaluation be distinguished. These deal with the macro-level and micro-level concepts of plan evaluation introduced earlier in Chapter 1. Both Stages 1 and 2 would deal with the four plan alternatives, though it is possible that under Stage 1 one or more of these alternatives might have been eliminated.

Note that the general thrust through all four suggested stages of plan evaluation lies in achieving increasing subarea detail and specificity at each succeeding stage.

Consequently, Stage 1 would deal primarily with macro-level analysis and evaluation. Emphasis here would be placed upon the aggregate outputs of the various mathematical models, as they are converted into relevant evaluative criteria. Overall costs of the various regional functional systems would be estimated. Primary emphasis would be placed upon assessing how goals and objectives are achieved at regional and major subregional levels.

Stage 1 would establish the most basic differences and similarities among the plan alternatives. Frequently summary measures and indices for the region as a whole would be used to document these comparisons. A quick, generalized picture of each alternative would result. Emphasis would be placed upon the broader structural characteristics of each plan-form development pattern. Stage 1 will permit staff, citizens, and decision makers to *begin* to form conclusions about each alternative, though considerable additional information must still be considered.

In general, Stage 1 may be compared to the level of effort typically expended on evaluation in many



SUGGESTED STAGING OF PLAN EVALUATION
Figure 6

other metropolitan areas. For example, the traditional user-oriented benefit/cost ratios for assessing alternative regional highway plans would be covered here. These analyses generally delve no deeper than the summary regional economic data generated for each alternative. Further subarea comparisons are not made.

The extensive further efforts recommended for Stages 2 and 3 of the evaluation process consequently offer potentials for major improvements in plan evaluation methodologies. Both the time and the manpower required for a more careful and searching examination of plan options have been judiciously set aside by the CPO. Stages 2 and 3, and the iterative cycling concepts on which they are based, provide a means for focusing these expanded efforts. Almost for the first time, it will be possible to evaluate a metropolitan plan (and its alternates) on a much more systematic and rational basis.

Stage 2 will place emphasis on further plan detailing, partially through further analysis of model outputs, and through additional estimation of alternative plan characteristics. Model outputs will be stratified on a small-area basis, utilizing additional computer subroutines where necessary. The key to this micro-level analysis capability will lie in the relatively fine-grained level of disaggregation (663 Traffic Analysis Zones) incorporated within the Projective Land-Use Model (PLUM). PLUM represents the single most important of the various systems simulation and forecasting models under development.

At this point, forecasts of differences in local public service costs (schools, fire and police protection, local governmental services, etc.) also will be introduced. Emphasis would now be placed upon differences among the alternatives in terms of small-area impacts. Examination of how the alternatives may vary at these more detailed levels (for example, census tracts or traffic analysis zones) will be necessary to determine how comparisons among all alternatives might best be made.

In general, Stage 2 should be expected to establish the more subtle differences and similarities among the plan alternatives. For example, it is likely that for some (perhaps many) criteria where regional totals show relatively little difference, a more careful look at small-area characteristics will show significant variation among various key subareas. These differences must also be considered, particularly by the local jurisdictions and community groups involved. Subarea and jurisdictional comparisons among plan alternates will consequently form an important part of Stage 2.

Also important to Stage 2 will be the use of evaluative criteria which are generally more detailed than those used in Stage 1. This detail will result in part from the further stratification of more general goals into more specific objectives and sub-objectives. It will also result from the disaggregated consideration of goals on a subarea basis, so that each subarea of concern may be regarded as contributing its part to the overall regional level of goal-achievement. Greater emphasis on functional plan alternatives (transportation, open space, housing, etc.), rather than on the broader plan-form concepts, will also lead to more detailed evaluative criteria.

It should be noted that, in actuality, Stages 1 and 2 would be likely to overlap to some degree. This would be necessary in order to accommodate the varying schedules upon which different functional planning programs are proceeding. These functional planning programs are expected to provide both alternative plan components and the data and criteria upon which different alternatives will be assessed. As mentioned subsequently in Chapter 5, further refinement and development of criteria, themselves, is likely to occur throughout both Stages 1 and 2. The review and refinement of regional goals by the Goals Committee will also occur during Stage 1.

Feedback between Stages 1 and 2 is likely to be considerable. There will also be important implications for the manner in which the alternative plans, themselves, are further refined, with additional plan characteristics forecasted or estimated, beyond the outputs provided by the simulation models. This type of refinement can properly be regarded as iterative *planning,* building upon the results and requirements of associated evaluation efforts. The incremental planning and detailing of the various alternates will parallel the evaluation process.

It should be recognized that many specific directions and types of criteria for Stage 2 will depend upon previous results and findings of both Stage 1 and related Stage 2 investigations. Consequently, it is not possible to lay out in full detail all the different plan comparisons to be made. Much will depend upon where the interesting similarities and differences lie, which cannot yet be anticipated. A good deal of flexibility will be needed in carrying out Stages 2 and 3.

It is also especially significant that many important evaluation considerations, such as those dealing with staging, the mixing and matching of different plan components across functional areas, and the consideration of short-run versus long-run

impacts, have all been deferred to subsequent phases (Stages 3 and 4) of evaluation. This seems reasonable, in light of the fact that considerable effort would be required to address such factors meaningfully for only one alternative plan. It is likely that additional realism and detail would be required of that plan before such considerations could be addressed. Consequently, it seems premature to attempt to examine these issues for all four, necessarily more general, regional plan alternatives.

Stage 3 of the recommended evaluation process would begin only after a single, preferred regional plan has been selected. It would then be concerned with evaluating a number of possible staging options for implementing that plan. Emphasis would generally be placed upon the various functional systems whose capital investment staging could be expected to influence the directions and rate of regional growth. Many different possible mixes of functional system components could be envisioned as specific staging options.

However, a strategy will be developed for formulating a limited number of generalized options (corridors or sectors, for example) and evaluating them. Marginal variations in goal-achievement and cost-effectiveness analyses conducted previously for the preferred alternative will be examined. Emphasis will be placed on the *timing* of different impacts, as short-run and long-run effects are distinguished. Both large-area and small-area differences among the staging options will be assessed.

Though not a part of the planning/evaluation work program considered here, Stage 4 of the evaluation process may well be the most important of all. It is at this point that specific capital improvement projects (or private development proposals) would be evaluated prior to construction. Consideration of the local neighborhood impacts of these projects will be required, perhaps at a level of detail not previously achieved.

Emphasis would be placed in several directions. Coordination with other imminent or ongoing projects of various types would be essential. Short-run impacts upon the surrounding locality must be considered carefully. Trade-offs between regional and local community goals will be necessary, and the possibility of conflict and controversy over pertinent goals must be recognized. Strategies emphasizing citizen participation in dealing with these conflicts must be developed.

Stage 4 would be conducted on a project-by-project basis, and would be likely to extend for a considerable period of time. A regularized procedure for project evaluation should consequently be devised, to be repeated many times within each functional area of regional planning. This most detailed level of plan evaluation, conducted at the point of actual implementation, will represent a sort of final checkpoint for ensuring that both regional and community goals will be achieved.

In terms of many of the problems and opportunities discussed in the State-of-the-Art report, this four-stage approach to plan evaluation appears to offer a workable means for better organizing the evaluation task. It should be carefully reviewed at this time, however, to insure that it is compatible with the Overall Program Design of the CPO. It is anticipated that a considerable level of effort will be required to carry through both Stages 1 and 2, with somewhat less effort required for Stage 3.

GENERALIZED WORK PROGRAM

The general staging concepts described above have been cast in the form of a time-phased work program for plan evaluation. This recommended work program stretches over much of the next two years, with the results of Stages 1 and 2 evaluation permitting the selection of a preferred plan by July 1, 1973. Stage 3 will then permit the selection of a preferred staging pattern for the recommended plan by January 15, 1974.

A critical aspect of the evaluation work program lies in its integral coordination with related planning activities. Consequently, it has been developed as a *planning/evaluation* work program. Some 42 specific work items have been identified which will be necessary to permit its completion. Thirty-one of these work items will deal primarily with evaluation and evaluation-related tasks, while the remaining 11 will deal primarily with the development of planning policies and staging alternatives which will in turn be based upon the results of evaluative effort. These related planning activities will fall into three general areas: developing a policies plan, identifying staging alternatives, and developing a regional capital improvements program.

Only three of the four basic stages of evaluation, itself, are contained within the recommended work program. As discussed above, the fourth stage of evaluation, which relates to the implementation of specific projects, will be conducted on an ongoing basis. The timing of this fourth stage will depend upon the timing of individual projects and was considered to fall beyond the scope of this work program. In addition to the three basic stages which are included, an additional element in the

work program involves several preliminary sub-tasks necessary for the inauguration of evaluation. As illustrated in Figure 7, this first phase of inauguration would precede Stages 1, 2, and 3.

Figure 7 suggests how the various broad elements of the planning/evaluation work program can be coordinated to permit the development of a regional capital improvements program by May 1, 1974. Several overlaps in this work program should be mentioned, since they will call for especially careful orchestration of the many sub-tasks involved.

First, it should be noted that Stage 1 cannot begin until approximately November 1, 1972, because it will not be until that date that the bulk of the mathematical model forecasting outputs (primarily PLUM and the transportation models) will be available for conversion into evaluative criteria. In the meantime, however, a number of different important preparatory tasks can be completed under the inauguration phase. A target date of July 1, 1973, has correspondingly been set for completion of the various tasks involved in the Stage 2, micro-level phase of evaluation, in order to permit the selection of a preferred plan at that time. Consequently, in order to meet these schedule constraints, both Stages 1 and 2 must be overlapped.

July 1, 1973, has been set as the target date for plan selection in order that associated regional policies can be identified and incorporated within a Regional Policies Plan by October 1, 1973. The latter date has been accepted as the region's target for plan selection and documentation for some time.

A second important area of overlap lies with the development of the Policies Plan and the identification and evaluation of staging options. In order to meet a suggested target date of May 1, 1974, for the completion of a Regional CIP report, it will be necessary to complete Stage 3 of evaluation by approximately the preceding January 15. Stage 3 consequently should begin immediately upon the completion of Stage 2, thereby overlapping the preparation of the Policies Plan report. Considerable levels of CPO staff involvement are required during this period. Policies for achieving the recommended plan must be defined simultaneously with the more detailed definition of possible staging options. These options will deal with the *where* and *when* of the various functional system components which will comprise the more generalized recommended policies plan.

A third level of overlap will occur within Stage 3, as depicted in Figure 7. Here a very closely coordinated pattern of developing alternative staging plans and, in turn, evaluating them must be achieved. Probably the degree of coordination required between the planning and evaluation will be higher during Stage 3 than at any previous point in the planning/evaluation work program. This will be due in large measure to the greater detail at which each of the functional plans must be considered and, as noted above, because the evaluation must now begin to consider the *timing* of different impacts. The identification and evaluation of staging options consequently is likely to be highly interactive, with no clear division between these two activities.

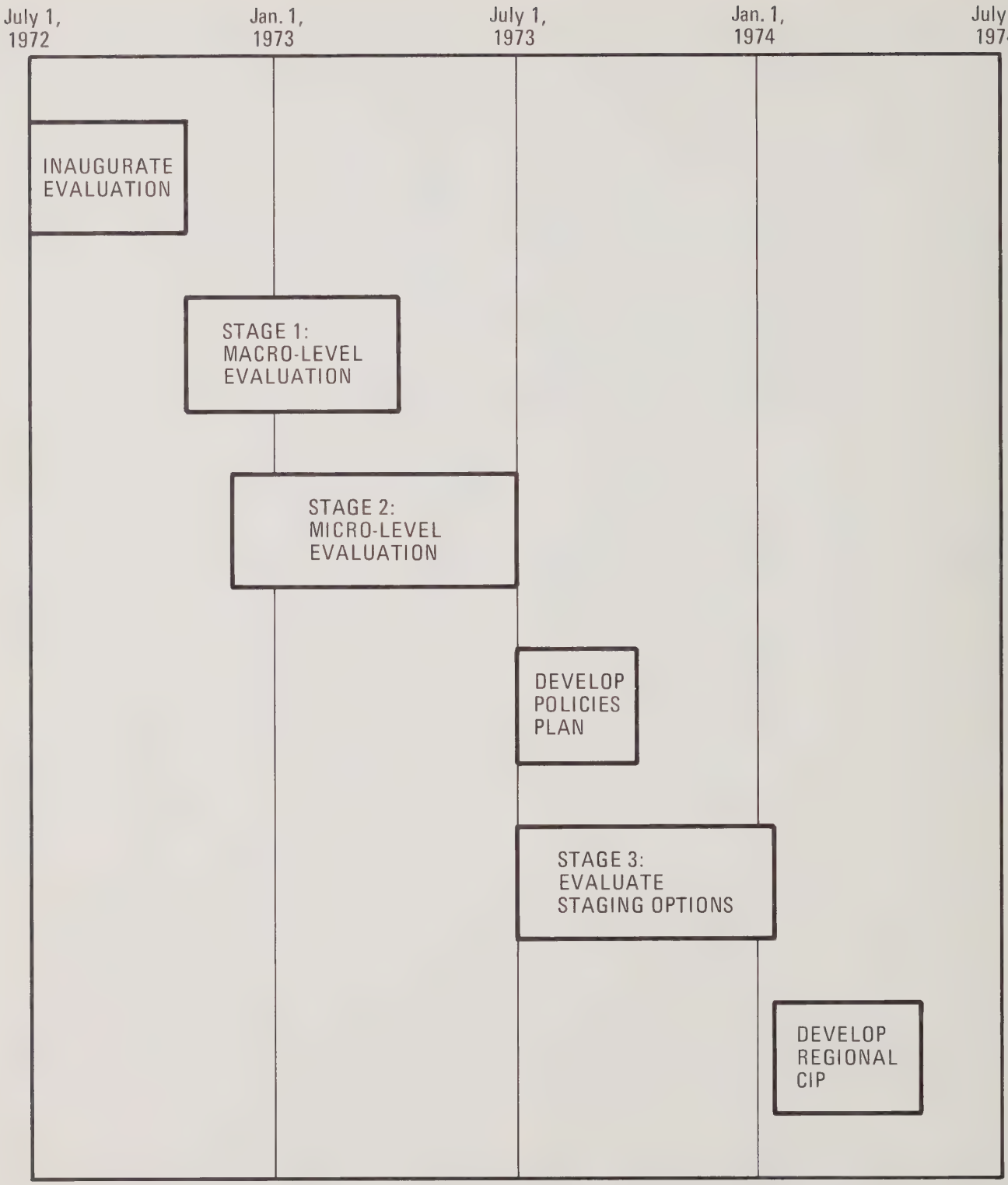
SUMMARY OF EVALUATION WORK ITEMS

The various, more detailed, sub-tasks comprising the six generalized phases of planning/evaluation depicted in Figure 7 can be summarized as follows.

The *inauguration of evaluation* will involve several work items critical to both Stages 1 and 2. Additional effort must be devoted to developing computer subroutines which can transform certain land-use and transportation model outputs into more meaningful criteria. Two already completed mathematical models, dealing with urban drainage consequences and regional park attractiveness, must be reapplied to provide appropriate criteria for each alternative plan. In preparation for Stage 1, many different preliminary large-area criteria must be further refined, while techniques for forecasting non-model based criteria of this type must also be perfected and applied.

Also in preparation for Stage 1, it will be desirable during this inauguration period to conduct the first series of Delphi survey sessions which have been recommended. During these sessions the relative importance of more general goals within the region would be explored. Two additional work items critical to both Stages 1 and 2 will involve the development of a sensitivity analysis model and a local governmental costs model. A sensitivity analysis model has been recommended as a means for attaching levels of confidence to the results of evaluation, particularly in the testing of the effects of different sets of goals weights on evaluation outcomes. A local governmental costs model is needed in order to provide a full range of cost-revenue and cost-benefit impacts, both regional and local in character, for each of the different plan alternatives.

Both *Stages 1 and 2* will involve five critical tasks which will form the heart of the evaluation



GENERALIZED PLANNING/EVALUATION WORK PROGRAM
Figure 7

effort. These five tasks offer major opportunities for improving the state-of-the-art in plan evaluation. They are generally innovative in character, and, if completed successfully, could well be of major value in strengthening this important phase of the overall regional planning process. In each case, differences in carrying out these five tasks under Stages 1 and 2 will lie largely in whether large-area or more numerous and detailed small-area criteria are involved.

The first task would involve the *goal achievement analysis* of each alternative. Here the various criteria to be derived from different model and non-model forecasting sources will be matched against the objectives to which they apply. Forecast data for each alternative plan will be organized according to a basic goals-achievement format, perhaps in the form of tables or matrices (see Table 3 and Figures 4 and 5). The next work item would then involve the *scoring of each alternative,* by introducing the relative weights assigned to goals which have emerged from the Delphi surveys of various decision-maker and community groups. Different sets of weights should be considered. By combining a goal-achievement or effectiveness score for each alternative with an associated relative weight, for each different objective, it will be possible to derive weighted effectiveness scores for each goal area, and then to sum these scores for different goals and objectives to yield an overall index or indices of plan desirability.

Under the third work item, regional and local system costs would be introduced. These costs would be matched against various measures of effectiveness for each plan alternative, yielding summary *cost-effectiveness indices.* This step will represent the implementation of a basic cost-effectiveness evaluation strategy, earlier recommended as an improved way to evaluate governmental plans and programs (see Chapter 3). The cost-effectiveness ratios or indices which result will form a primary basis for plan evaluation.

The next important area of methodological improvement will lie in the application of the *sensitivity analysis model* described briefly above. The sensitivity of alternative plan scores to uncertainties in relation to goal weights (different sets of weights for different community groups and interests), impact forecasts (acknowledging the uncertainties associated with mathematical models, in particular), and cost forecasts will be examined. More careful investigation and analysis of the differences between plan alternatives thus will be possible.

The fifth important work item under both Stages 1 and 2 will involve the *presentation of evaluation results* to decision makers and to other concerned citizens and groups. This work item will be devoted to the development and application of innovative communicative techniques (graphs, charts, maps, etc.) for presenting and effectively summarizing the results of plan comparisons and evaluations. Care will be taken not to overwhelm the decision maker with masses of unorganized data, nor to present him with oversimplified plan scores which conceal valuable information.

Another important area of activity in both Stages 1 and 2 will involve *citizen participation* in evaluation. During Stage 1, this participation will involve a review of the plan-form alternatives, using the forthcoming Alternative Plans Report as a guide. Citizen inputs and responses should then be incorporated within Stage 1 cost-effectiveness and sensitivity analyses, as well as within the presentation of results. Specific techniques for participation will be selected and refined. During Stage 2, citizen participation will involve the review of an interim report which summarizes the results of Stage 1, particularly with relation to the different functional systems plans. Again, the results of this citizen input will be incorporated within the cost-effectiveness and sensitivity analyses of Stage 2 and in the presentation of results to decision makers.

A number of additional work items are also incorporated within Stage 1 which essentially involve additional preparation for the undertaking of Stage 2. These would include the monitoring of the development of various systems simulation models (housing market analysis, air quality model, water and sewer service model); the development of any additional model subroutines which may be required; the refinement of small-area criteria; any refinements in alternative plans which may be suggested by revisions in goals; and the additional forecasting of non-model criteria at the small-area level.

Additional work items included within Stage 2 will involve the conduct of a second round of Delphi survey sessions, concentrating on more specific objectives within individual goal areas. A final review of all systems models will also be conducted to insure that their outputs have been fully incorporated within the various criteria for plan evaluation.

It should also be stressed that the presentation of results during Stage 2, when combined with the presentation of results of Stage 1, will stretch over a five-month period. These presentations will culminate in the selection of a preferred alternative

plan by the CPO Policy Committee. This five-month period of presentation, review, deliberation, and evaluation by the Policy Committee will represent perhaps the most critical phase of the entire planning-evaluation work program. It will require that the preceding cost-effectiveness and sensitivity analyses are thoroughly carried out and presented in such a form that they will be understandable and interpretable by Policy Committee members.

Stage 3 will also have several important subtasks. As noted above, these will include both planning and evaluation activities. Rerunning of the PLUM and transportation models over five to 10-year increments will represent a primary way for detailing the types of staging which must be considered. These will lead to the definition of several generalized staging options and the reconciliation of these options in terms of land-use/transportation plans and relationships and in terms of environmental plans and relationships.

A cost-effectiveness analysis of these staging options will be conducted, stressing differences in the timing of impact at both large-area and small-area levels. Differences among these options will represent marginal changes in the overall levels of goal achievement for the preferred plan examined during Stages 1 and 2. Consequently, the level of effort required here should be less. A sensitivity analysis of this cost-effectiveness of the staging options still will be conducted, however. Presentation of results again will be made to the CPO Policy Committee and a preferred pattern of staging will be selected.

The remaining two elements of the generalized work program shown in Figure 7 are treated simply in the overall planning/evaluation work program. Development of a Policies Plan will involve the specific definition and coordination of regional policies in various functional areas, and the preparation of a final report which both assembles those policies and documents and the results of the plan evaluation itself.

The development of a Regional Capital Improvements Program will involve both the definition of a time-phase pattern of capital expenditures for each regional system (highways, transit, water, sewer, open space, flood control, housing), as well as an associated governmental financing plan covering the various state, local, and federal sources for funding. The capital improvements program, financing plan, and the results of Stage 3 evaluations all will be incorporated in a final capital improvements program and plan report.

Table 4 summarizes the manpower requirements estimated to accomplish the six phases of the planning/evaluation work program depicted in Figure 7. A total of some 88 man-months of effort in various evaluation tasks would be required. Of this total, about 57 man-months would be provided by CPO staff and an additional 31 man-months by an evaluation consultant. In addition, approximately 51 man-months of related planning activities would be required to produce both the Policies Plan and the Regional Capital Improvements Program.

In Table 5, these manpower requirements are presented in a slightly different form. Manpower categories are reorganized according to the major methodological steps contained within each of the three stages of evaluation. They are also summarized on an annual basis, showing that a majority, 66 percent, of the overall planning/evaluation workload would occur during the first year of the work program, from June 30, 1972 to June 30, 1973.

Table 4
MANPOWER REQUIREMENTS: PLANNING/EVALUATION WORK PROGRAM

Phase	CPO Man-months		Evaluation Consultant Man-months
	Evaluation	Planning	
I. Inaugurate Evaluation	15.0	—	9.0
II. Stage 1: Macro-level Evaluation	16.0	2.0	8.0
III. Stage 2: Micro-level Evaluation	11.5	3.0	9.0
IV. Develop Policies Plan	4.0	8.0	2.0
V. Stage 3: Evaluate Staging Options	6.5	24.0	2.0
VI. Develop Regional CIP	4.0	14.0	1.0
Totals	57.0	51.0	31.0

Table 5
ADDITIONAL BREAKDOWN OF MANPOWER REQUIREMENTS

Task Area	Evaluation Activities		Related Planning Activities
	CPO Staff Man-months	Consultant Man-months	CPO Staff Man-months
FIRST YEAR (June 30, 1972 – June 30, 1973)			
1. Develop Sensitivity Analysis Model		3.0	
2. Refine Models and Criteria	21.0	8.0	
3. Goal-achievement Analysis	3.0	3.0	
4. Goal-weighting	7.5	5.0	
5. Cost-effectiveness Analysis	2.5	3.0	
6. Sensitivity Analysis	3.0	3.0	
7. Presentation of Results	5.5	1.0	
8. Citizen Participation			5.0
Totals, 1st Year	42.5	26.0	5.0
SECOND YEAR (June 30, 1973 – June 30, 1974)			
9. Policies Plan Report	4.0	2.0	8.0
10. Rerun Land-use and Transportation Models			12.0
11. Define Staging Options			12.0
12. Cost-effectiveness Analysis	2.0	1.0	
13. Sensitivity Analysis	2.0	1.0	
14. Presentation of Results	2.5		
15. Implementation Program Report	4.0	1.0	14.0
Totals, 2nd Year	14.5	5.0	46.0
Grand Totals	57.0	31.0	51.0

Chapter 5
DEVELOPMENT OF CRITERIA

In a series of tables presented in the full project report, various suggested criteria for evaluating alternative plans in the San Diego region are listed. They are organized according to specific preliminary objectives identified within the Regional Goals Program. They have been developed through the cooperative efforts of Goals Program staff, CPO research staff, and consultant staff. It should be stressed that, at this point, these criteria can only be regarded as preliminary. Their final refinement will depend on both the final revision of goals, through the Goals Program, which is expected over the summer, as well as through additional insights gained and adjustments made in the actual application of criteria, once the plan evaluation process itself is begun.

IMPORTANT CHARACTERISTICS OF CRITERIA

Several of the key characteristics of these basic, preliminary criteria are described below:

1. All of the various criteria listed in the nine goals-criteria tables fall into one of *three categories.* First, some are expressed in monetary terms, such as the costs of various public facility systems, median family income in different zones, or expected tax revenues in different subareas. Second, other quantitative measures are also represented, such as vehicle-miles of travel, residential densities in various areas, or the number of major commercial centers scattered throughout the region. Third, various qualitative measures are also included, such as subjective ratings of housing quality, subjective estimates of neighborhood individuality potentials, or subjective estimates of regional park diversity potentials. All three types of criteria will be important for meaningful plan evaluation.

2. These various criteria are also identified, in each of the nine tables, according to *three major sources* or methods by which they may be forecasted. First, many of the criteria have been stated in terms of the known or anticipated output variables of several different mathematical simulation models currently operational, under development, or planned for use within the region. The Projective Land-Use Model (PLUM) and the California Division of Highways Transportation Planning Models are examples. Second, other quantitative or data-based criteria can be derived via (a) additional hand or computerized analyses of basic model outputs (such as the mapping of travel-time contours), or (b) analyses of other data not treated by the basic set of models (for example, analyses of industrial wage characteristics). Third, forecasts of qualitative plan characteristics must be made by CPO and local planning agency staffs in the form of numerical ratings or rankings.

3. An additional important characteristic of many criteria is the *level of aggregation* at which their application is suggested. Six different levels are represented within the nested zonal system of the region, ranging from the region as a whole down to 663 different traffic analysis zones. Plan evaluations conducted in other regions have typically focused on the upper end of this spatial hierarchy (region-as-a-whole or large districts), ignoring possible differences among small areas. This approach has recently been criticized, as discussed earlier in Chapter 1.

   Consequently, preliminary designations of small-area applicability have been made for those criteria which appear to have meaning at this level. The point here is that there may be small-area differences among plan alternatives which are not otherwise noticeable. As discussed previously in Chapter 4, in order to deal manageably with criteria examined at different

levels of aggregation, it appears necessary to define two successive stages in evaluating plan alternatives—the first dealing with large-area criteria and the second dealing with small-area criteria. Stage 2 offers an opportunity for major improvements in plan evaluation methodology.

4. In the development of these various criteria, an important distinction emerged in the *time horizons* of plan evaluation. In general, an attempt has been made to gear most of the criteria towards the 1995 target year of the four different plan-form alternatives. PLUM, the transportation models, and other models utilize 1995 as their basic forecast year.

   However, many types of criteria, particularly those relating to socioeconomic conditions and social programs, can be suggested which are shorter-range in nature. These criteria, not generally included within the various simulation models to be utilized, consequently relate more strongly to an annual monitoring activity, rather than to a long-range forecasting and evaluation effort. Examples include school achievement test results, college enrollment rates, crime rates of various types, disease rates of different types, unemployment rates by race, public welfare case loads, and similar indicators. The forecasting of these types of criteria or indicators is presently not included within the region's overall modeling strategy. Most of them are susceptible to change via short-range social action programs and program improvements, rather than through long-range plans which are primarily physical in nature.

5. Consequently, the types of criteria and indicators which might be utilized in *short-range monitoring*—which is considered here to be an extremely important type of plan and program evaluation—are not considered in depth. These types of criteria and this level of evaluation are considered to fall beyond the scope of the long-range, regional plan-form evaluation effort with which this assignment is concerned. However, it should be noted in passing that physically-oriented as well as socially-oriented plans and programs are equally in need of annual monitoring. Such monitoring (dealing, for example, with zoning changes, rates of residential development, shopping center location, pollution levels, open space acquisition rates, etc.) are necessary, on a year-by-year basis, in order to determine if a long-range plan is being implemented effectively.

6. In fact, it should also be observed that many *additional criteria,* other than those listed, are likely to become needed in the area of short-range monitoring of both physical and social changes and growth. It is expected that many of these will deal with the specifics of subarea or local jurisdiction plans, programs, and projects. For example, the many guidelines and standards set forth in planned unit development regulations, zoning ordinances, and subdivision regulations all represent detailed criteria. Many such criteria will also be qualitative in nature, calling for the subjective rating and assessment of various program and project characteristics. It should be clearly recognized that, at the general, overall regional planning level at which the plan evaluation process under discussion here will be conducted, sufficient local specificity is simply not available to permit many of these more detailed and qualitative criteria to be meaningfully applied.

ORGANIZATION OF CRITERIA

While the nine goals-criteria tables are organized in a manner consistent with the proposed approach to evaluative comparisons (see Chapter 3), a second method of organization also illustrates how criteria can be utilized more effectively. This approach focuses on the different functional systems around which the regional plan alternatives will be developed (highways, transit, utilities, open space, etc.). Four major categories of criteria appear to be important here—those dealing with system performance, system feasibility (cost), socioeconomic impacts, and political feasibility. These categories of criteria are illustrated in Tables 6 through 9 and discussed below.

Four different system performance criteria are depicted in Table 6. These performance measures would be applied primarily at the regional and large-area level. Examples of each of these performance measures are matched against each of the seven different regional systems for which functional plans are being prepared. Nearly all criteria would be forecasted via the mathematical modeling associated with each functional planning area. (All of these criteria are also included in the nine more-detailed criteria tables, matched against the goals and objectives with which they are most closely associated.) Each of these performance measures, in the areas of total flow or quantity, system efficiency, system density, and system distribution, would provide a fundamental means

Table 6
SYSTEM PERFORMANCE CRITERIA

Functional System(1)	Performance Measures: Total Flow or Quantity	System Efficiency	System Density	System Distribution
Highways	Vehicle-miles Vehicle-hours	Average trip distance Average trip time	Volume/capacity ratios, selected links	Percent travel via expressways Percent intrazone travel
Transit	Passenger-miles Passenger-hours	Average trip distance Average trip time	Percent standees, selected routes	Percent transfers Percent wait time Percent walk time
Water/ Sewer	000 gal. carried or pumped	Average flow per mile of pipe	Miles of major trunk lines	Percent D.U.'s on private systems
Drainage	Peak flow, cubic feet per second	Average flow per channel	Number of acres potentially flooded	Miles of streams or channels affected
Open Space	Acres	Population/ acre	Annual visits/ acre	Number of zones with 40 percent or more in open space
Housing	Number of single-family units Number of multi-family units	Population/ dwelling unit	Dwelling units/ acre	Number of zones with 40 percent or more residential development
Air Resource	Average pollution levels	Number of high pollution days Average pollution duration	Number of critical pollution sites	Number of zones with air pollution problems

(1) Mathematical simulation models available or anticipated for each.

Table 7
SYSTEM FEASIBILITY CRITERIA

Functional System[1]	Feasibility Measures: Total Cost[2]	Cost per Unit Flow or Quantity	Cost per User or D.U.	B/C or R/C Ratio[2]
Highways	Major arterials Expressways	Cost per mile Cost per vehicle-mile	Cost per vehicle-trip	Transport Benefits/ Costs[3]
Transit	Fixed facilities Vehicles Operations	Cost per passenger-mile	Cost per passenger trip	Transport Benefits/ Costs[3]
Water/ Sewer	Sewer system Water system	Cost per 000 gallons	Cost per connection Cost per dwelling unit	—
Drainage	Flood control improvements	Cost per channel Cost per cubic ft. peak flow	Cost per capita Cost per acre protected	—
Open Space	Acquisition Development Operations	Cost per acre	Cost per capita Cost per user	Recreation Benefits/ Costs[4]
Housing	Government-assisted housing only	Cost per dwelling unit	Cost per capita	—
Air Resource	Not applicable[5]	—	—	—
Local Government Services	Elementary and high school education, municipal services	—	Cost per student Cost per capita Cost per dwelling unit	Property and sales Tax revenues/ school and municipal costs

(1) System cost analyses and/or models in each area, including local government services, are assumed.

(2) Both capital and annual operating costs would be considered.

(3) Where transport benefits cover reductions in vehicle operating costs, accident costs, parking costs, and travel time.

(4) As defined by open space consultant.

(5) Costs for air pollution control assumed to be met largely by the private sector.

Table 8
SOCIOECONOMIC IMPACT CRITERIA

Land-use Category(1)	Socioeconomic Measures			
	Number of Dwelling Units or Employees	Accessibility	Density	Distribution
Single-family Residential	Number of dwelling units	To employment To shopping To open space	D.U./acre	Number of zones with 40 percent or more S-F residential development
Multi-family Residential	Number of dwelling units	To employment To shopping To open space	D.U./acre	Number of zones with 20 percent or more M-F residential development
Low-income Residential	Number of dwelling units	To employment To education	D.U./acre	Number of zones with 10 percent or more L-I D.U.
Moderate-income Residential	Number of dwelling units	To employment To education	D.U./acre	Number of zones with 10 percent or more M-I D.U.
Basic Employment	Number of employees	To population	Employees/acre	Number of industrial parks Number of zones with 20 percent or more industrial development
Retail-Service Employment	Number of employees	To nearby population	Employees/acre	Number of major shopping centers Residential L-U/Ret.-Serv. L.U.
Education Employment	Number of employees	To nearby population	Employees/acre	Residential L-U/education L-U Number of higher educational centers
Other Employment	Number of employees	To population	Employees/acre	Number of zones with 10 percent or more other empl. L-U

(1) As defined by the Projective Land-Use Model (PLUM).

Table 9
GOVERNMENTAL COMPATIBILITY CRITERIA

Governmental Jurisdiction	Compatibility Measures: Regional Plan Alt./Local Plans Ratio: Population	Resid. L-U	Empl. L.U.	Open Space	Local Satisfaction Index(1)	Strength of Local Codes and Ordinances(1)
Carlsbad						
Chula Vista						
Coronado						
Del Mar						
El Cajon						
Escondido						
Imperial Beach						
La Mesa						
National City						
Oceanside						
San Diego City						
San Diego County						
San Marcos						
Vista						

(1) Subjective estimates, using a 1-10 rating scale.

for comparing the different plan alternatives in terms of their basic functioning.

Table 7 provides a comparable set of system feasibility or cost criteria, for each of the different systems included in Table 6. Added to this table are measures relating to the cost of local governmental services. Four different dimensions of system cost or feasibility appear to be important—total cost, cost per unit flow or quantity, cost per user or dwelling unit, and, where relevant, cost/benefit or cost/revenue ratio. Again, these measures provide a basic means for comparing different plan alternatives. They would be made available via the various cost analyses and forecasts associated with each of the functional planning efforts. A separate cost model would be needed to forecast the different local governmental costs associated with different plans. Note that the traditional cost/benefit ratio for highway plans, covering dollar-valued user benefits in the area of accidents avoided, reduced operating costs, and travel-time savings, would be included here. Cost/revenue ratios for local governmental services would utilize revenue forecasts provided by PLUM. These system feasibility criteria would also be applied to the regional and large-area levels.

In Table 8, a sampling of basic socioeconomic impact criteria is listed. All of these illustrative criteria would be available as outputs of the PLUM model. These criteria would be applied at both the regional or large-area level, as well as at the local or small-area level. These criteria, organized by basic land-use category, are a general representation of the combined socioeconomic impacts of the seven different functional systems considered in Tables 6 and 7. Most of the additional criteria listed in the complete criteria tables also deal, in one way or another, with socioeconomic impacts or conditions.

It should be recognized that more detailed tables of this type should be prepared at the program and project levels, within each functional system, dealing with more detailed neighborhood-level impacts. As noted above, however, these types of impacts fall beyond the scope of this assignment. They could provide a major focus for Stage 4 of the recommended planning/evaluation process. Four different types of socioeconomic measures are

listed in Table 8, again providing a fundamental basis for comparing different alternative plans. These criteria deal with accessibility, number of dwelling units or acres, density of development, and distribution of development.

While each of the three previous tables deals with criteria which would be forecasted by various mathematical simulation models, Table 9 lists preliminary criteria which are primarily subjective in nature. They deal with the likely political feasibility of different alternative plans. The general idea here is to make a qualitative assessment of the relationship of alternative plan characteristics in different subareas to the locally prepared plans of comparable governmental jurisdictions. For example, if one of the region's suburbs were allocated an extensive amount of residential growth, whereas little growth was desired under its local plans and ordinances, there would be much less political feasibility or likelihood of this plan actually being implemented.

Compatibility of growth projections and allocations among subareas with local plans and desires is consequently the keynote here. The different criteria suggested, again utilizing outputs of the PLUM model, deal with ratios between projected activity levels and local plan estimates for different land-use categories, as well as subjective estimates of the strength of local codes and ordinances, and subjective estimates of the likelihood of local satisfactions with regional versus local alternative plan differences. This table is clearly more tentative than the others, but addresses an element of plan evaluation likely to be particularly influential in the final selection of alternatives by the CPO.

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